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Interim Report

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ACCEPTABILITY OF SHELTER RATIONS IN COMBINATION WITH ADJUNCTS

By: HERBERT STONE, S.M. OLIVER, J. M. KLOEHN, AND R. C. SINGLETON

Prepared for:

OFFICE OF CIVIL DEFENSE
DEPARTMENT OF THE ARMY
OFFICE OF THE SECRETARY OF THE ARMY
WASHINGTON, D.C. 20310
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SRI Project 4949-500

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I. INTRODUCTION

This report represents our results to date on investigations of the acceptability of adjuncts for use with present civil defense shelter rations.

The concept of adjunct and ration acceptability evolved from an earlier report on the OCD ration program (Stone, 1965). At that time, an evaluation of existing data indicated that the wafer, biscuit, and cracker rations were acceptable to individuals confined in a shelter for as long as 14 days. It was also noted that ration palatability needed improvement and/or that other means of increasing ration consumption were necessary. The use of adjuncts to be served with the ration was suggested as a way to increase palatability. Since most adjuncts were developed for use with the wafer, it was decided that data on their acceptability with all three rations was important, as was knowing if all adjuncts were equally acceptable.

It is hoped that our increased knowledge about their palatability may provide insights into increasing the acceptability and consumption of shelter rations.

II. SUMMARY AND RECOMMENDATIONS

The improvement of ration acceptability was approached through the use of adjuncts (spreads) developed to increase palatability.

Studies of adjunct acceptability with all three rations showed that preferences were not similar when measured by a panel of typical shelter habitants (171 subjects). Of 57 adjuncts, 15 were most preferred with all three rations; 15 were least preferred; the remaining 27 had intermediate preference rankings. On the basis of data from the present experiment, any of the 15 most preferred adjuncts could be used in a shelter habitability study. These include, in order of decreasing preference:

- lemon topping
- chicken soup
- chicken gravy
- onion soup
- chili-beef soup
- raspberry jelly
- lemon icing
- prune sauce
- chili sauce
- grape jelly
- vanilla topping
- wild cherry jelly
- lemon jelly
- beef-mushroom soup
- strawberry jelly

Since many shelters will not have a heat source, it may be necessary to replace the hot items with the next six adjuncts. The new list would include the following items, in order of decreasing preference:

- lemon topping
- raspberry jelly
- lemon icing
- prune sauce
- chili sauce
- grape jelly
- vanilla topping
- wild cherry jelly
- lemon jelly
- strawberry jelly

mashed potato salad
prune-peach sauce
chocolate pudding
wild cherry spread
orange jelly

The effects of age, sex, and regional background on the rank order preference for the adjuncts did not appear to significantly alter this sequence. There were insufficient numbers in most of the groupings to justify any changes in the preference sequences listed. Only the specific rank assigned the adjunct was changed, and not in any consistent manner.

Since this test was only a single trial of the complete experiment, it is difficult to estimate the importance of (a) adjunct-ration interactions and subject variability in the over-all preference rankings and (b) food monotony in the shelter situation. It was not possible to test for these factors in this experiment, but they warrant further study. Furthermore, such data would reduce the number of studies required to adequately test all the aforementioned adjuncts in an actual shelter situation.

III. EXPERIMENTAL

To evaluate the acceptability of adjuncts proposed for use with the shelter rations, a series of taste tests were carried out using SRI staff members as subjects. The experiments did not take place in a shelter, since the information required at this preliminary stage could be obtained more easily and economically in the laboratory. No evaluation of the shelter rations alone was undertaken, and the only adjuncts studied were those developed by the USDA Western Regional Research Laboratory (Shepherd et al., 1962). Criteria of adjunct selection, the experimental design, panel selection, sample preparations, test procedure, and method of analysis are detailed in the following sections.

Our objective was to determine if all the adjuncts were equally acceptable with all three shelter rations and which adjuncts were most acceptable when served with each ration.

A. Experimental Design

The experimental design was based on the assumption that data would be more meaningful if subjects tasted just a few of the many adjuncts (with a ration) only once and ranked them according to preference. Experiments with other foods have shown that data are more representative of the general population if such a procedure is used (Amerine et al., 1965). Furthermore, the tests were conducted within the shortest possible time, to minimize changes in adjunct quality due to storage after preparation.

The experiment was planned to permit a preference ordering of the 57 adjuncts for each of the rations--wafer, biscuit, and cracker. Adjuncts that scored high in preference with all three rations would then be logical candidates for general use in shelters, and those that scored low with all three rations could be eliminated from further consideration. Study of preference differences among the three rations was not considered as part of this experiment; in fact, the design used did not allow such comparisons.

The experiment was conducted over three days of taste testing, a different ration being used on each day. The possibility of having each subject rank all 57 adjuncts with a given ration at a single sitting was ruled out as impractical. It was thus necessary to find a systematic, balanced plan for ranking smaller sets of adjuncts. We chose a balanced, incomplete block design with 57 treatments (adjuncts), 57 subjects, and 8 treatments per subject (Cochran and Cox, 1957). Plan 13.3a (op. cit., p 533) was used, with block 21 corrected to read 21, 26, 53, 36, 48, 4, 31, 9. The parameters of this design were $t = 57$, $k = 8$, $b = 57$, and $\lambda = 1$. Each subject was presented with an ordered set of eight samples, i.e., eight adjuncts in combination with a single ration type. The subject was asked to taste each sample, swallowing or not, as preferred, but rinsing his mouth with water between samples, then to rank the eight samples in order from most preferred to least preferred. Each adjunct was presented once in the first position, once in the second position, ... once in the eighth position. Each pair of adjuncts appeared exactly once in the experimental layout. The eight samples presented to a subject accounted for 28 pairs of adjuncts, and the 57 subjects accounted for all 1,596 pairs.

The adjuncts were numbered for identification, then the 57 treatment numbers in the design layout were randomly permuted, using a computer. Four independently randomized sets of design cards (one card per subject) were punched out for use in the experiment, one for a preliminary trial day and three for the actual experiments. A serving tray of eight samples was made up for each subject in the order specified on a card, and the card was kept with the tray. The rating sheets filled out by the subjects were coded to correspond with the design cards. Record keeping was simple, and went smoothly.

B. Panel Selection

The panel was selected from volunteers who responded to an advertisement in the Institute's newsletter, and through personal contact by the experimenters. Potential subjects were given a brief description of the

study and asked to participate on one of three days for ten minutes to evaluate foods prepared for use in the civil defense shelter program. At the appointed time, subjects were given a brief description of the study and additional instructions by the principal investigator (Appendix A). No effort was made to select certain individuals or to preclude volunteers unless an illness (e.g., cold) interfered with their normal sensory functions. Subjects were encouraged to comment on the test and the products and at the conclusion of the test were given a questionnaire on food likes, dislikes, and related biographical data. This was to be completed and mailed back at leisure.

C. Sample Selection and Preparation

The use of adjuncts as nutritional supplements and, mainly, as a way to increase palatability and acceptability of OCD shelter rations originated in response to results of shelter habitability studies, which showed that shelter occupants did not eat all the rations available to them. Shepherd et al. (1962) at Western Regional Research Laboratory and Newlin and Hayes (1965) at Midwest Research Institute studied the concept and developed 70 adjuncts, which were subjected to some screening for acceptability. We believed that this number should be reduced.

Our 57 samples (Table 1) were chosen on the basis of criteria considered to be of importance to the civil defense program, including cost and storage stability. In consultations with the OCD Technical Office, it was decided to eliminate items costing more than \$.014 per serving and items that, in our opinion, would not meet stability requirements. Breakfast cereal (Shepherd et al., 1962), a low cost item, was not tested since preliminary evaluation with the biscuit and cracker showed low acceptance.

Samples were prepared as specified by Shepherd et al. (1962). The experiments were set up to enable shelter conditions to be followed as closely as possible. However, there were obvious differences, in that all 57 adjuncts were prepared only once each day for testing, producing the situation depicted in Fig. 1. Jellies were prepared first, to allow for the three-hour setting time, and then fruit spreads, toppings, fruit



FIG. 1 REHYDRATED ADJUNCTS READY TO BE SERVED. Hot items are shown on the left, covered with foil to maintain serving temperature.

sauces, and icings. Hot items--soups, gravies, and chili sauce--were prepared just prior to the tests. These hot adjuncts were prepared in stainless steel beakers insulated to maintain a typical hot serving temperature. Glass-distilled, charcoal-filtered water at ambient temperature (approximately 22°C) was used for adjunct preparation and for drinking water. Distilled water was used because water variability throughout the country precludes replicability in shelter situations. All water volumes were measured in graduated cylinders to minimize errors in rehydration.

D. Test Procedure

Each panelist was presented with eight samples served in waxed paper cups identified by code number. The cups were held in a white tray with grooves to keep them in order so sampling could proceed from left to right according to the design sequence (Fig. 2). The ration, together with the appropriate adjunct, was placed in the cup less than 15 minutes before serving. The hot adjuncts were served in ramekins placed in the cups, and were added to the ration immediately before serving. Each panelist was presented with a score sheet, coded with the sample number. The design cards were removed from trays just before serving. A sample score sheet is shown in Appendix B. After tasting the samples in sequence from left to right, subjects were permitted to retaste as often as they wished before ranking the samples. Upon completion of the test, panelists returned their score sheets and were given the questionnaire described earlier (Appendix C).

E. Method of Analysis

For each day's experiment, the 57 rating sheets from subjects were punched onto cards for analysis. Using a computer, a preference score was calculated for each adjunct. For a given adjunct, this score was computed by counting the number of adjuncts over which it was preferred, minus the number of adjuncts preferred to it. The resulting preference score p_j for the j -th adjunct was thus one of the 57 possible even numbers in the range $-56 \leq p_j \leq 56$. Since there were only 57 possible values for the preference score, some tie scores resulted except in the unlikely

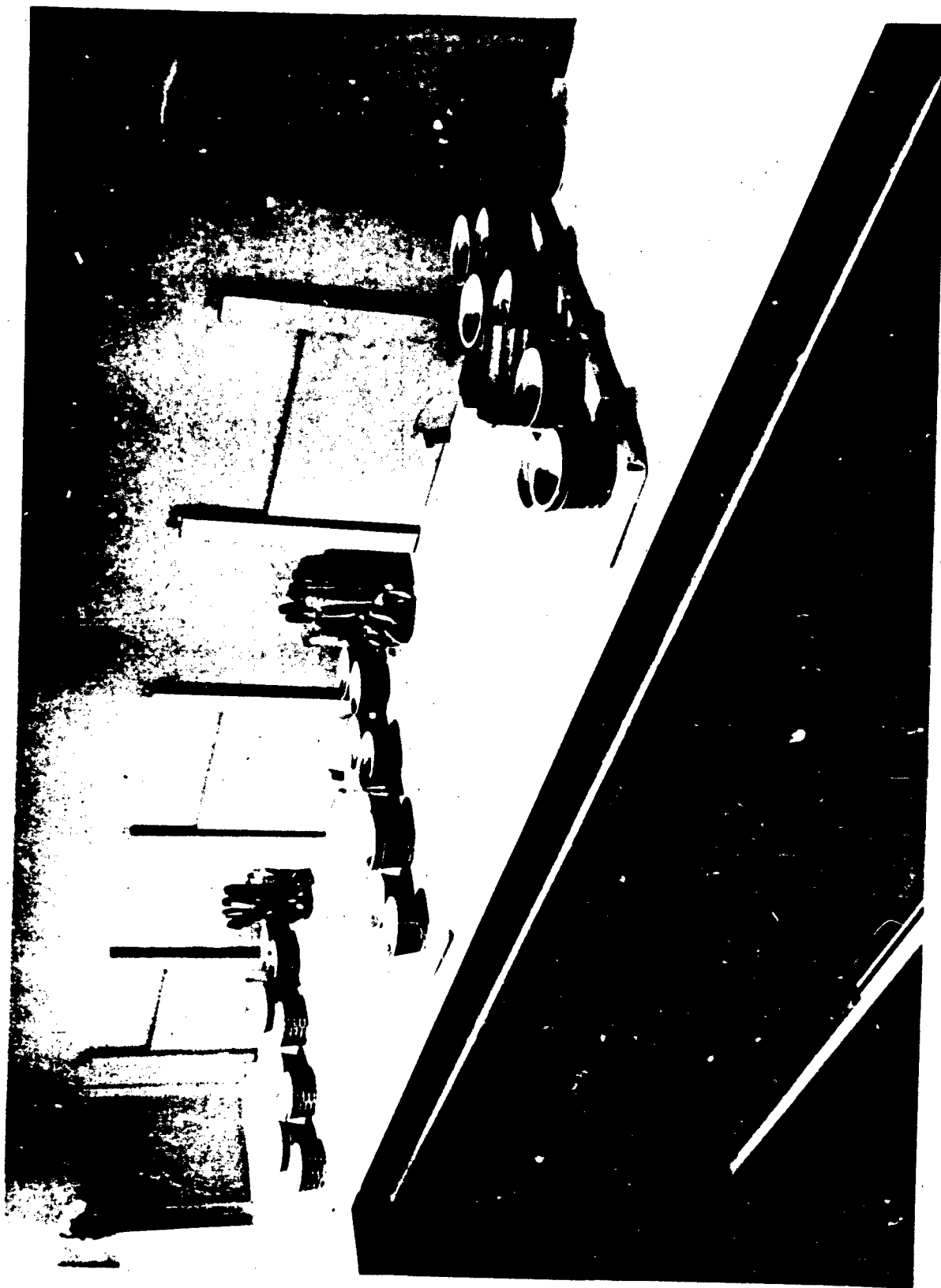


FIG. 2 PREPARED SAMPLE FOOD CUPS AND DESIGN CARDS ON SERVING TRAYS. Hot items are placed in ramekins; cards are removed from trays just before samples are presented.

case of perfect consistency of ranking by all subjects. The adjuncts were then arranged in decreasing order of preference score, and preference ranks from 1 to 57 were assigned, using an average rank in the case of ties.

The three days' results were then combined, adding the three preference scores for each adjunct to obtain its over-all preference score, and an over-all ranking was obtained. In addition, a preference statistic

$$t = \frac{6}{n(n^2-1)} \sum_{j=1}^n (n+1-j)p$$

where $n = 57$

was computed for each ration. This statistic lay between zero and one, having the value zero for the original design layout and the value one only if all subjects ranked the adjuncts with perfect consistency. It gives a measure of the degree of consistency of ordering.

The biographical responses were treated similarly, but analysis by computer was not possible. The panel was not balanced according to age, sex, or regional background since all subjects were randomly selected volunteers. The individual rankings of each subject were assigned values of +7, +5, +3, +1, -1... (from most preferred to least preferred). These values were summed and averaged, since equal numbers of subjects did not evaluate all the adjunct-ration combinations in any one grouping. These data were then assigned ranks, as described above.

IV. RESULTS

The results of the tests are summarized in Tables 1-3. Table 1 shows the over-all preference scores assigned the adjuncts, based on the combined scores from the individual rations. The data are listed in decreasing order of preference. Observation of the assigned scores with each ration gives some measure of the degree of concordance for the adjuncts with all three rations.

The over-all and individual ration preference rankings are listed in Table 2, in order of over-all preference. The adjuncts were then divided into eight groups, based on above or below median (29) ranking with each of the three rations; these groupings are shown in Table 3. Fifteen adjuncts had median or above preference ranking with all three rations, and another fifteen had below median preference ranking with all three. The remaining 27 adjuncts are listed according to their median or above preference rankings with two or only one of the rations.

The preference statistic was also calculated and the following values were obtained:

Wafer	0.529
Biscuit	0.573
Cracker	0.490

Unfortunately, the distribution of this statistic is not known, so we can say only that the preference ordering was most consistent in the case of the biscuit, least consistent in the case of the cracker.

The data clearly delineate the 15 adjuncts most preferred and the 15 least preferred. The original objective--to reduce the total number of adjuncts--was realized; however, a number of questions remain unanswered.

No attempt was made to establish the significance and/or importance of the differences between the scores assigned the adjuncts. The over-all preference scores in Table 1 range from 88 to -74. Obviously, there are significant differences even between the first thirty adjuncts (all positive

TABLE 1
PREFERENCE SCORES OF ADJUNCTS

ADJUNCT	OVERALL	MAFER	HISCUIT	CRACKER
LEMON TOPPING	88	42	20	26
CHICKEN SOUP	72	36	12	24
CHICKEN GRAVY	68	24	24	20
BEEF SOUP	56	-2	38	20
ONION SOUP	54	4	28	22
CHILI-BEEF SOUP	52	6	30	16
RASPBERRY JELLY	48	4	14	30
LEMON ICING	48	14	22	12
PRUNE SAUCE	48	14	22	12
CHILI SAUCE	48	2	32	18
MASHED POTATO SALAD	40	20	28	-8
PRUNE-PEACH SAUCE	34	16	-2	20
GRAPE JELLY	28	14	0	14
VANILLA TOPPING	28	8	10	10
WILD CHERRY JELLY	26	8	8	10
CHOCOLATE PUDDING	26	32	-12	4
LEMON JELLY	24	22	0	2
APRICOT SAUCE	24	-2	28	-2
WILD CHERRY SPREAD	22	16	14	-8
BEEF-MUSHROOM SOUP	22	4	4	14
STRAWBERRY JELLY	20	0	14	4
PINEAPPLE JELLY	18	18	-12	12
ORANGE JELLY	18	6	-2	14
PAPRIKA GRAVY	18	-4	-2	24
LEMON SPREAD	16	2	22	-8
CHOCOLATE ICING	14	22	-10	2
GRAPE SPREAD	4	0	-2	4
BUTTERSCOTCH TOPPING	4	36	-8	-24
PEACH JELLY	2	-8	2	4
DATE BUTTER	2	-4	4	2
APPLE JELLY	-2	-14	10	2
ORANGE TOPPING	-4	26	-28	-2
APRICOT-PEACH BUTTER	-8	4	20	-32
WILD CHERRY TOPPING	-10	-8	-30	28
NUTMEG TOPPING	-10	12	-20	-2
RASPBERRY SPREAD	-12	0	-16	4
BLACK FIG BUTTER	-12	-20	14	-6
WILD CHERRY ICING	-18	-16	8	-10
STRAWBERRY SPREAD	-26	-14	4	-16
APPLE SPREAD	-26	-8	-10	-8
ORANGE ICING	-28	-18	-6	-4
PRUNE-RAISIN SAUCE	-28	-18	18	-28
PEACH SPREAD	-30	-18	-2	-10
PINEAPPLE SPREAD	-34	-20	2	-16
CHOCOLATE MINT PUDDING	-44	-4	-14	-26
GRAPE TOPPING	-44	-20	-20	-4
PINEAPPLE TOPPING	-44	-12	-16	-16
RASPBERRY ICING	-46	-28	-10	-8
ORANGE SPREAD	-48	-12	-22	-14
PEACH ICING	-50	-2	-18	-30
RASPBERRY TOPPING	-54	-22	-44	12
PINEAPPLE ICING	-56	-20	-22	-14
PEACH TOPPING	-64	-26	-24	-14
GRAPE ICING	-66	-24	-32	-10
APPLE ICING	-66	-14	-32	-20
STRAWBERRY ICING	-68	-22	-18	-28
STRAWBERRY TOPPING	-74	-32	-18	-28

TABLE 2
PREFERENCE RANKING OF ADJUNCTS

ADJUNCT	OVERALL	WAFER	BISCUIT	CRACKER
LEMON TOPPING	1	1	11.5	3
CHICKEN SOUP	2	2.5	12	4.5
CHICKEN GRAVY	3	6	7	8
BEEF SOUP	4	31	1	8
ONION SOUP	5	22.5	5	6
CHILI-BEEF SOUP	6	19.5	3	10
RASPBERRY JELLY	8.5	22.5	15.5	1
LEMON ICING	8.5	18	9	16.5
PRUNE SAUCE	8.5	18	9	16.5
CHILI SAUCE	8.5	25.5	2	12.5
MASHED POTATO SALAD	11	9	5	28
PRUNE-PEACH SAUCE	12	11.5	32	8
GRAPE JELLY	13.5	14	28.5	12.5
VANILLA TOPPING	13.5	17.5	19.5	19.5
WILD CHERRY JELLY	15.5	17.5	21.5	10.5
CHOCOLATE PUDDING	15.5	4	40.5	23
LEMON JELLY	17.5	7.5	28.5	27.5
APRICOT SAUCE	17.5	31	5	31
WILD CHERRY SPREAD	19.5	11.5	15.5	38
BEEF-MUSHROOM SOUP	19.5	22.5	24	12.5
STRAWBERRY JELLY	21	28	15.5	23
PINEAPPLE JELLY	23	10	40.5	16.5
ORANGE JELLY	23	19.5	32	12.5
PAPRIKA GRAVY	23	34	32	4.5
LEMON SPREAD	25	25.5	9	38
CHOCOLATE ICING	26	7.5	38	27.5
GRAPE SPREAD	27.5	28	32	23
BUTTERSCOTCH TOPPING	27.5	2.5	36	51.5
PEACH JELLY	29.5	37	26.5	21
DATE BUTTER	29.5	34	24	27.5
APPLE JELLY	31	42	19.5	27.5
ORANGE TOPPING	32	5	53	31
APRICOT-PEACH BUTTER	33	22.5	11.5	57
WILD CHERRY TOPPING	34.5	37	54	2
NUTMEG TOPPING	34.5	16	48.5	31
RASPBERRY SPREAD	36.5	28	43.5	25
BLACK FIG BUTTER	36.5	49.5	15.5	35
WILD CHERRY ICING	38	44	21.5	42
STRAWBERRY SPREAD	39.5	42	24	48
APPLE SPREAD	39.5	37	38	38
ORANGE ICING	41.5	46	35	33.5
PRUNE-RAISIN SAUCE	41.5	46	13	58.5
PEACH SPREAD	43	46	32	42
PINEAPPLE SPREAD	44	49.5	26.5	48
CHOCOLATE MINT PUDDING	46	34	42	53
GRAPE TOPPING	46	49.5	48.5	33.5
PINEAPPLE TOPPING	46	39.5	43.5	48
RASPBERRY ICING	48	56	38	38
ORANGE SPREAD	49	39.5	50.5	45
PEACH ICING	50	31	46	56
RASPBERRY TOPPING	51	52.5	57	16.5
PINEAPPLE ICING	52	49.5	50.5	45
PEACH TOPPING	53	55	52	45
GRAPE ICING	54.5	54	55.5	42
APPLE ICING	54.5	42	55.5	50
STRAWBERRY ICING	56	52.5	46	58.5
STRAWBERRY TOPPING	57	57	46	51.5

TABLE 3
PREFERENCE GROUPING OF ADJUNCTS

ADJUNCT	OVERALL	WAFER	BISCUIT	CRACKER
MEDIAN OR ABOVE PREFERENCE WITH ALL RATIONS				
LEMON TOPPING	1	1	11.5	3
CHICKEN SOUP	2	2.5	18	4.5
CHICKEN GRAVY	3	6	7	8
ONION SOUP	5	22.5	5	6
CHILI-BEEF SOUP	6	19.5	3	10
RASPBERRY JELLY	8.5	22.5	15.5	1
LEMON ICING	8.5	14	9	14.5
PRUNE SAUCE	8.5	14	9	16.5
CHILI SAUCE	8.5	25.5	2	12.5
GRAPE JELLY	13.5	14	28.5	12.5
VANILLA TOPPING	13.5	17.5	19.5	19.5
WILD CHERRY JELLY	15.5	17.5	21.5	19.5
LEMON JELLY	17.5	7.5	28.5	27.5
BEEF-MUSHROOM SOUP	19.5	22.5	24	12.5
STRAWBERRY JELLY	21	28	15.5	23
MEDIAN OR ABOVE PREFERENCE WITH WAFER AND BISCUIT ONLY				
MASHED POTATO SALAD	11	9	5	38
WILD CHERRY SPREAD	19.5	11.5	15.5	38
LEMON SPREAD	25	25.5	9	38
APRICOT-PEACH BUTTER	33	22.5	11.5	37
MEDIAN OR ABOVE PREFERENCE WITH WAFER AND CRACKER ONLY				
PRUNE-PEACH SAUCE	12	11.5	32	8
CHOCOLATE PUDDING	15.5	4	40.5	23
PINEAPPLE JELLY	23	10	40.5	16.5
ORANGE JELLY	23	17.5	32	12.5
CHOCOLATE ICING	26	7.5	38	27.5
GRAPE SPREAD	27.5	28	32	23
RASPBERRY SPREAD	35.5	26	43.5	25
MEDIAN OR ABOVE PREFERENCE WITH BISCUIT AND CRACKER ONLY				
BEEF SOUP	4	31	1	8
PEACH JELLY	29.5	37	26.5	21
DATE BUTTER	29.5	34	24	27.5
APPLE JELLY	31	42	19.5	27.5
MEDIAN OR ABOVE PREFERENCE WITH WAFER ONLY				
BUTTERSCOTCH TOPPING	27.5	2.5	36	51.5
ORANGE TOPPING	32	5	53	31
NUTMEG TOPPING	34.5	16	48.5	31
MEDIAN OR ABOVE PREFERENCE WITH BISCUIT ONLY				
APRICOT SAUCE	17.5	31	5	31
BLACK FIG BUTTER	36.5	49.5	15.5	35
WILD CHERRY ICING	38	44	21.5	42
STRAWBERRY SPREAD	39.5	42	24	48
PRUNE-RAISIN SAUCE	41.5	46	13	54.5
PINEAPPLE SPREAD	44	49.5	26.5	48
MEDIAN OR ABOVE PREFERENCE WITH CRACKER ONLY				
PAPRIKA GRAVY	23	34	32	4.5
WILD CHERRY TOPPING	34.5	37	54	2
RASPBERRY TOPPING	51	52.5	57	16.5
BELOW MEDIAN PREFERENCE WITH ALL RATIONS				
APPLE SPREAD	39.5	37	38	38
ORANGE ICING	41.5	46	35	33.5
PEACH SPREAD	43	46	32	42
CHOCOLATE MINT PUDDING	46	34	42	53
GRAPE TOPPING	46	49.5	48.5	33.5
PINEAPPLE TOPPING	46	39.5	43.5	48
RASPBERRY ICING	48	56	38	38
ORANGE SPREAD	49	39.5	50.5	45
PEACH ICING	50	31	46	56
PINEAPPLE ICING	52	49.5	50.5	45
PEACH TOPPING	53	55	52	45
GRAPE ICING	54.5	54	55.5	42
APPLE ICING	54.5	42	55.5	50
STRAWBERRY ICING	56	52.5	46	54.5
STRAWBERRY TOPPING	57	57	46	51.5

values); however, the importance of these differences remains to be demonstrated.

The results of the biographical questionnaires provided additional supportive information about the preference scores for the different adjunct-ration combinations. Table 4 shows the panel distribution based on age group and regional background and Table 5, the panel distribution by sex. Observation of the regional backgrounds revealed that four geographic areas accounted for two-thirds of the panelists, a highly unbalanced situation. The panel distribution by age group appeared better; however, the breakdown according to ration-adjunct combinations reduced the number of responses per sample. Thus, 20 percent of the ration-adjunct combinations were not tasted. In general, the top thirty items were most preferred; however, adjunct preference rankings showed variation from ration to ration and within different age groups. There was no consistent pattern to the preference scores and, until more data are collected for each age group, no definitive conclusions are possible regarding the change in preference with age.

The effect of sex on the preference rankings was similar to the results reported for the different age groups; the thirty median or above preference adjuncts were not grossly affected by sex differences. Although there were obvious differences between the rank scores by men and women, there was no evident pattern for any product type. More definitive conclusions are not possible because of the sample size, which ranged from zero to a maximum of eight. The data tend to confirm earlier conclusions that the preference rank order of the top fifteen to thirty most preferred adjuncts may change with continued testing but will remain primarily within the same group.

Since this work was done in the laboratory, it is important to study acceptability of the most preferred adjuncts with the rations in a shelter situation. We did not consider the problem of food monotony and believe that, in addition to retesting the most preferred adjuncts, it is important to know if the preference rankings are affected by continued consumption.

Table 4

**BIOGRAPHICAL INFORMATION ABOUT THE PANEL: REGIONAL BACKGROUND
AND AGE OF THE PANELISTS IN THE THREE RATION GROUPS**

Age Group ^b	Region ^a												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Wafer													
20-24			1				2					1	4
25-29			4			1		1	1	1		1	9
30-34	1	1	4	1			1	2	1	2		1	14
35-39	1	1	3					1	2		1	2	11
> 40	1		8		1	2	1		2	2		1	18
Total	3	2	20	1	1	3	4	4	6	5	1	6	56
Biscuit													
20-24	1		3				2		2	1	1	1	11
25-29		1	7			2	2	1	2			4	19
30-34			2			1						1	4
35-39			4							1		1	6
> 40	4		2		1	1	3		2			1	14
Total	5	1	18	0	1	4	7	1	6	2	1	8	54
Cracker													
20-24	2		6			1	1						10
25-29			6	1				1	1	1		4	14
30-34		1	7	1	1		2		2	1			15
35-39			2	3			2				1		8
> 40			2				2		2	1			7
Total	2	1	23	5	1	1	7	1	5	3	1	4	54

^aRegions of the country appear by name in Appendix C.

^bNo subject was less than 20 years of age.

NOTE: The absence of a number indicates no subject in this category; also, seven subjects did not return their biographical questionnaires.

Table 5

DISTRIBUTION OF THE PANELISTS BY SEX

Ration	Male	Female	Total
Wafer	35	22	57
Biscuit	26	31	57
Cracker	34	23	57
Total	95	76	171 ^a

^a Although seven subjects did not return their biographical questionnaires, their sex was known.

Food monotony could overcome the improvement in acceptability of the adjunct-ration combinations and further depress ration consumption. An alternative technique might be to limit the use of adjuncts to one or two meals per day.

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Appendix A

INSTRUCTIONS TO PANELISTS

Appendix A

Thank you very much for offering to assist us in this study. We are interested in the acceptability of Civil Defense rations. Your task is to tell us which products you prefer and the order of preference by tasting them and completing a questionnaire. After you have read these instructions, please enter the taste facility and be seated at any one of the booths. You will then receive a score sheet and 8 samples. Taste each one, from left to right, and rank them in order of your preference for them. You may retaste each sample as often as you wish; however, we are primarily interested in your first impression of the products. There are no "incorrect" answers so do not spend too much time over any one product as this may tend to confuse you. Water is available for rinsing between each sample if you so desire. It should take no more than 5 minutes to complete the test but you may take longer if necessary.

If you have any questions, please ask the experimenters.

Thank you very much for participating.

Department of Food Sciences and Nutrition

Verbal Instructions: "You may swallow the samples if you desire, but be sure that you rinse your mouth between samples. There is no time limit on tasting; however, previous experiences indicate that your first impression is probably your best."

Appendix B

SAMPLE SCORE SHEET

Appendix B

NAME _____ DATE _____ CODE _____

We are interested in knowing your preferences for the foods in front of you. Taste each sample in order, from left to right, and rank them according to your preference. You may swallow the samples. Please rinse your mouth between samples, or use the large container.

You may retaste the samples as often as you wish and you may rearrange the order in which they were presented to you. List the samples by number in order of preference: the most preferred, first and the least preferred, last.

If you have any questions please ask the experimenter.

Thank you.

_____	Most preferred

_____	Least preferred

COMMENTS:

Appendix C

POST-TEST QUESTIONNAIRE

Appendix C

FOOD SCIENCES STUDY

4949-500

NAME	LOCATION	EXT
------	----------	-----

Please check one answer to each question:

Time in Calif.

1. Less than 2 yrs _____
2. 2 - 5 yrs _____
3. 5 - 10 yrs _____
4. Over 10 yrs _____

Marital Status

1. Single _____
2. Married _____
3. Divorced _____

Sex

Regional Background. Please check the area in which you spent most of your life before you were 16 years old. Check only one number. If you traveled or lived in different regions of the U.S. for short periods, check No. 11.

1. _____ Northwest: Ore., Wash., Idaho
2. _____ Rocky Mountains: Nev., Colo., Wyo., Utah, Mont.
3. _____ Southwest: Calif., New Mex., Ariz.
4. _____ South Central: Tex., La., Okla., Ark.
5. _____ Great Plains: Mo., Iowa, Kans., Nebr.
6. _____ North Central: N. Dak., S. Dak., Minn.
7. _____ Middle West: Ill., Ind., Wisc., Mich.
8. _____ Southeast: Miss., Ala., Tenn., Fla., N.C., S.C., Va., Ga., Ky.
9. _____ East Central: Ohio, Pa., N.Y., N.J., Del., W. Va., Md.
10. _____ New England: Me., Mass., N.H., Vt., R.I., Conn.
11. _____ Did not live in any of the above regions for more than a year or two
12. _____ Lived outside the U.S.

Age at last Birthday (Check one)

1. _____ Under 20
2. _____ 20 - 24
3. _____ 25 - 29
4. _____ 30 - 34
5. _____ 35 - 39
6. _____ 40 or over

FOOD SCIENCES STUDY

4949-50

We are interested in your personal preferences regarding the foods listed below. Place a check mark in the column that best describes your feeling about each food. If you have never eaten a particular food, check "Not Tried." This is purely a matter of personal preference, so there are no right or wrong answers.

	Not			Like			Dislike			
	Tried	Extremely	Much	Moderately	Slightly	Neither	Slightly	Moderately	Much	
Wild cherry jelly/jam										
Strawberry "										
Grape "										
Pineapple "										
Orange "										
Lemon "										
Raspberry "										
Apple "										
Peach "										
Beef soup										
Onion soup										
Chili-beef soup										
Cold breakfast cereal (gen)										
Chili sauce										
Paprika gravy										
Beef mushroom gravy										
Chicken gravy										
Chocolate pudding										
Chocolate mint pudding										
Vanilla pudding										
Butterscotch pudding										
Nutmeg										
Date butter										
Black fig butter										
Apricot peach butter										
Prune sauce										
Apricot sauce										
Prune raisin sauce										
Prune-peach sauce										
Potato salad										

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Stanford Research Institute		Unclassified
		2b GROUP
3 REPORT TITLE		
Acceptability of Shelter Rations In Combination with Adjuncts		
4 DESCRIPTIVE NOTES (Type of report and inclusive dates)		
5 AUTHOR(S) (Last name, first name, initial)		
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6 REPORT DATE	7a TOTAL NO. OF PAGES	7b NO. OF REFS
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13. ABSTRACT		
<p>The present civil defense rations, in combination with adjuncts designed to enhance their acceptability, were subjected to sensory evaluation by volunteers representative of the country's adult population. Fifteen adjuncts had median or above preference scores with all three rations; any of these could be used in shelter habitability studies. Information relating to the role of subject background, age, and sex on adjunct-ration preferences is presented, and its usefulness in increasing acceptability of the present rations is discussed. (U)</p>		

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14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Food acceptance						
Rations						
Adjunct-ration preferences						
Taste testing						
Sensory evaluation						

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